学位論文要旨

REGIONAL DIFFERENCES IN QUALITY OF PRIMARY EDUCATION IN CAMBODIA: FOCUSING ON INSTRUCTIONAL PROCESS IN URBAN AND RURAL SCHOOLS

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Introduction

Research Background and Objectives

Since near-universal enrollment in primary education has been attained by many developing countries, improving educational quality has become an imperative for these societies. Quantity of education (years of schooling) alone is insufficient for genuine learning to take place. It is through the provision of quality education that one gain skills and knowledge needed to better one's life and society. Goal 2 of the Dakar Framework for Action (2000) commits nations to the provision of primary education of 'good quality', and goal 6 includes commitments to improve all aspects of education quality so that recognized and measurable learning outcomes are achieved by all, especially in literacy, numeracy and essential life skills. Quality education as set out by the framework requires desirable characteristics of learners (healthy, motivated pupils), processes (competent teachers using active pedagogies), content (relevant curricula) and systems (good governance and equitable resource allocation) (UNESCO, 2005). However, providing such conditions usually poses a real challenge for impoverished countries, which have already been pressured by the efforts to improve educational access. As more and more children enter schools, the resource-strained education systems might not have enough capacity to accommodate them. The teacher might not be sufficiently prepared to cope with those children. Instructional resources and supplies might not be adequate. In fact, universal access to education are more likely to be achieved by expanding enrollments in existing schools, by packing more pupils into existing classrooms, by moving from full-day to half-day programs and by expanding the teacher force by hiring less qualified teachers (Smith & Motivans, 2007).

This study is designed to examine the quality of education in a context of expanded enrollment. The study will draw on lessons from a growing body of educational effectiveness research on how to conceptualize the problem of concern.

The purpose of this study is to explore the influence of a web of factors at classroom, school and beyond-school (context) levels on academic learning of pupils in primary schools. The study aims to answer the following four research questions:

1. What school and family factors are associated with pupils' achievement?
2. What is the effect of student-centered approach (SCA) policy on teachers' classroom practices?
3. What is the relationship between instructional process and pupils' achievement?
4. Are there any regional differences in resources, instructional process, and pupils' achievement in primary schools?

Review of Previous Studies

Since educational effectiveness has received due attention from educational researchers for more than half a century, a large body of literature has been accumulating. A number of terms are used to denote research on educational effectiveness. These include, to mention a few, school effects (Konstantopoulos, 2005), effective schools (Purkey & Smith, 1983), teacher effectiveness (Muijs

& Reynolds, 2000), teaching effectiveness (Seidel & Shavelson, 2007), instructional effectiveness (Fraser, 1989), and effective classroom (Creemers, 1994). It is important to note that these terms are used so inconsistently in the literature that, often, the task to define and distinguish between one and the other is almost impossible. Yet, all of these studies are interrelated and can be placed under the umbrella of educational effectiveness research (Creemers, Kyriakides & Sammons, 2010). The term 'educational effectiveness research' refer to an overarching theme that links together a conglomerate of research in different areas, including research on teacher behaviour and its impacts; curriculum; pupil grouping procedures; school organization; and educational policy (Creemers, Kyriakides & Sammons, 2010, p.3).

More recently, educational effectiveness research has attempted to conceptualize factors explaining difference in academic achievement in a more integrated model (Sammons et al., 1997; Teddlie & Stringfield, 1993). As Creemers (2008) asserts, "After the resurrection of research on the effect of education in the 1980s and 1990s, the extended (input-process-product-context) model could be applied again." The reason behind this motive is that research reviews (Scheerens & Bosker, 1997; Teddlie & Reynolds, 2000) have discerned numerous correlates of academic achievement at classrooms, schools, and above-school levels. For example, Teddlie and Reynolds (2000, p.142) in their review identified countless of the correlates of effective schools and grouped them into 9 interrelated areas: effective leadership; effective teaching; focus on learning; positive school culture; high expectations for pupil achievement; emphasis on pupil responsibility and rights; monitoring progress at all levels; staff development; and parental involvement.

The bulk of literature on educational effectiveness shows that the interrelation between school factors, classroom factors, pupil achievement, and other variables is so complex that any study attempting to measure the effect of education on pupil's learning which neglects teaching and learning process variables is subject to enormous flaw. Conversely, specifying only a link of factors at classroom level with pupil achievement will probably underestimate school effects. Therefore, an integrated model is needed so that various factors operating at different levels can be accounted for.

Research Methodology

Conceptual framework

Viewing academic learning as a product of a multitude of factors operating from different sources, this study adopt a comprehensive model which takes into account various teaching, school, and context variables. With factors at various levels included, this conceptualization can be described as a 'context-input-process-output' model (*Figure 1*).

This study poses three major hypotheses with respect to the relationships between these variables and pupils' academic learning: (1)quality of instruction is a major determinant of academic achievement; (2) school inputs may exert independent effect on academic learning or may function as conditions for quality of instruction; (3) As context variables, family

characteristics and formal context variables such as teaching and learning policy may also have independent effect on academic achievement or function as conditions for quality of instruction and better school resources. This study further assumes that factors at classroom level, which are grouped under 'quality of instruction' and placed at the center of Figure 1, are most important determinants of pupils' learning achievement because these factors are direct and most proximal causes of pupils' learning (Doyle, 1983; Muijs & Reynolds, 2002)
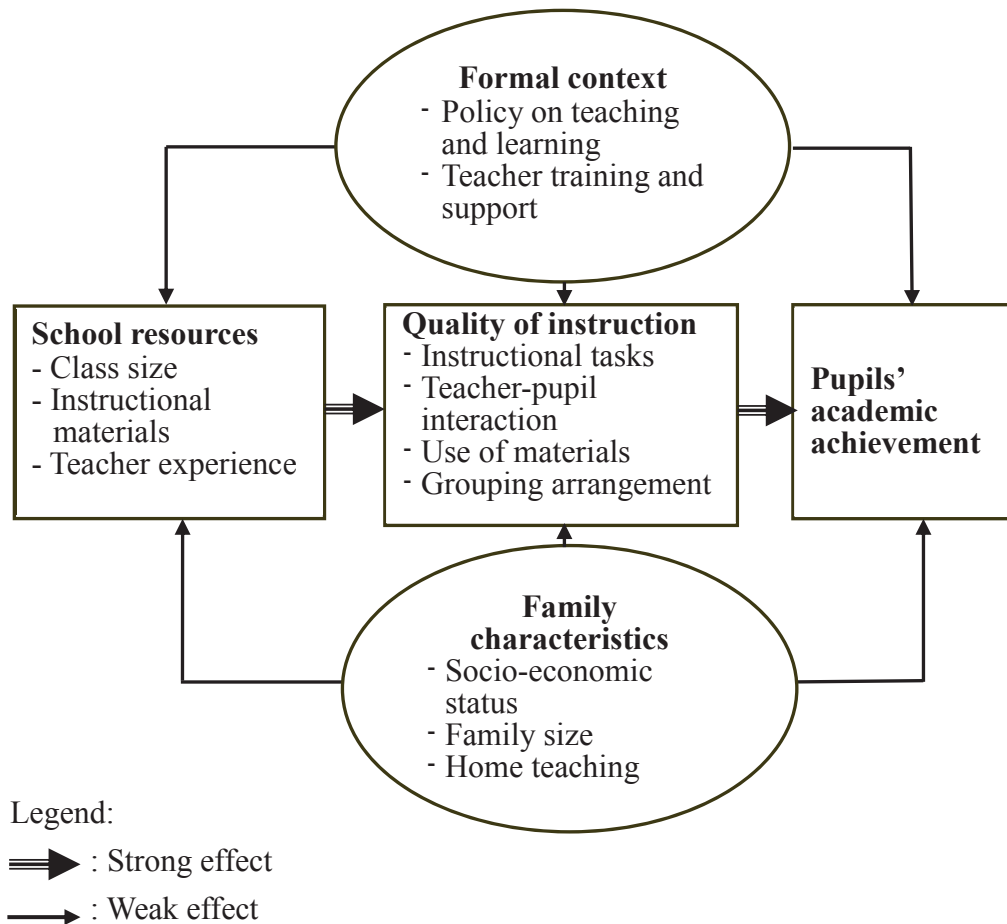

Figure 1: A conceptual framework of educational effectiveness

Research settings

The surveys for collecting primary data for this study were conducted in one rural district called Preah Netr Preah in Bantey Meanchey province and one semi-urban district called Angk Snuol in Kandal province (*see attached Map of Cambodia*). Angk Snuol district is located about 15 kilometers west of Phnom Penh and is a center for economic activities as evident in the presence of economic zones and garment factories which provide jobs for thousands of people while Preah Netr Preah is about 360 kilometers north-west of Phnom Penh and is still predominantly characterized by farming in terms economic activities. Only 4% of the households in Preah Netr Preah as compared to 30% in Angk Snuol had access to electricity. In Preah Netr Preah, almost all families (98%) had their main occupation as rice farmers, 1 % of the families were involved

in trading and services, and almost none (less than 1%) of the families had a member employed as private company staff or worker while the figures for the same indicators in Angk Snuol were 83%, 11%, and 40% respectively (National Committee for Sub-National Democratic Development [NCDD], 2009a, 2009b).

Research instruments and data

The data on which this study is based was collected through three times of fieldwork, each of which lasted for about two months. Various instruments were employed to collect these data including questionnaire surveys with principals, teachers, and pupils; interviews with teachers; achievement tests for pupils; and video-recoding of classroom teaching. A total of 1080 sixth-grade pupils from 32 schools (16 from each area) participated in the questionnaire survey and took test in math and Khmer language. The test was jointly made by experienced teachers in the field and the researcher based on the contents which teachers reported to have covered. Information about school resources and teaching conditions were also collected from the school principals and teachers in charge of those pupils. Thirty sixth-grade teachers were involved in interviews, during which they were asked about their teaching methods and their perception about their effects on pupils' learning. In another questionnaire survey, 391 teachers from the two districts were asked about their understanding, beliefs and implementation with regard to the newly-reformed pedagogy of student-centered approach. Chapter 1, Chapter 2, and Chapter 3 are mainly based on these questionnaires, interviews, and test data.

Video-recording of 12 mathematics lessons given by four teachers was taken by the researcher. The lessons given by each teacher (three lessons per teacher) were video-recorded at an interval of one week. The video-recording comprises the data for Chapter 4, Chapter 5, and Chapter 6.

Chapter 1: Primary Education in Cambodia

This chapter provides general description of educational provision, participation, and outcomes at primary education level.

Despite the decline in enrollment over the last ten years, there appear to be an increase in the number of school establishments, indicating a positive sign of access to primary education favoring children in rural and remote areas. At the present, rural children have schools closer to their homes and study in classes with fewer members than ten years ago, when the enrollment peaked. However, national data reveals that teacher in rural areas are still held in charge of more classes and pupils while teachers in urban areas enjoy better working conditions as they teach only one class per day, usually with fewer pupils. Such a difference, coupled with the lack of other resources such as textbooks, raises a big question on the quality of education in rural areas, where 85% of primary school pupils reside.

Educational participation has been improved especially since the abolition of enrollment fee in 2001. In 2012, the net enrollment rate in primary education reached 97 percent and the

growth in enrollment showed a negligible difference across gender and regions (MoEYS, 2013). There was a gradual increase in the percentage of pupils being promoted to higher grades over the years, and there were declining rates of both repeaters and dropouts, suggesting a better overall performance of Cambodian education system. However, though there was an improvement in the percentage of pupils who persisted in school up to grade 6, the last grade of primary education, the survival rate remained as low as 61.2 percent in 2010, meaning that almost 40 percent of the pupils dropped out of school before completing the primary cycle.

Chapter 2: School Effects on Academic Achievement

This chapter seeks to investigate school factors that improve learning achievement and is guided by two research questions: (1)How much is the variance in academic achievement explained by school factors as compared to home factors?; (2) What school factors are associated with higher academic achievement?

The results of OLS regression analyses (*Table 1, attached*) presented a considerable effect of school resources on pupil learning in Cambodia. After controlling for pupil background characteristics, school accounted for at least 35% of the variation in achievement scores. This is a relatively low effect as compared to that documented by the seminal work of Heyneman and Loxley (1983) and early education production function (EPF) studies reviewed by Fuller (1987). However, this finding of school effect is on par with more recent literature in developing countries (Riddell, 1997; Willms & Somers, 2001) and indicates greater school effect on academic achievement than that found in industrialized countries. The finding provides additional support for policies aimed at improving school resources to raise pupils' academic achievement. The study also identified three important aspects of school resources that were significantly correlated to pupil achievement: teacher experience, teacher guides and instructional time. Pupils performed better in schools with more experienced teachers, higher availability of guidebooks for teachers and longer annual instructional time than in schools with less of these resources.

A further analysis showed that schools in rural areas were at the disadvantageous end. Experienced teachers tended to move to more affluent areas to earn additional income from tutoring. Guidebooks for teachers were in less supply in rural schools. Furthermore, rural schools were more vulnerable to floods and teacher absence during harvesting seasons, which significantly reduces instructional time.

Chapter 3: Student-Centered Approach in Cambodia

This chapter has revealed some evidence of the impact of the so-called student-centered approach (SCA) reform on teachers' understanding of the reform ideas, beliefs about teaching and learning principles promoted by the reform, and classroom practices. The major conclusion of this chapter is, although student-centered approach has been warmly welcomed by most Cambodian primary school teachers, it has not yet been widely implemented and realized in

classrooms.

The survey results clarified that teachers tended to associate SCA with behavioral characteristics of instruction such as pupil activities, group work, teaching materials, and 5-step lesson. To Cambodian teachers, a typical SCA instruction, though not a prevalent practice, is the one that is characterized by 'pupils working in groups on problems in textbook assigned by the teacher.' With this conception, there appears to be a shift from the teacher doing all the talking (chalk-and-talk teaching style) towards pupils being engaged in doing activities (tasks) by themselves. However, teachers talk less about pupils' thinking levels or cognitive demand of the tasks they give to pupils even though the policies on teaching and learning emphasizes the development of higher-order cognitive skills such as analyzing, problem solving, and critical thinking. Teachers have allowed pupils to do more activities and introduced more materials into classroom, but hardly do these activities and materials challenge pupils to think harder. This shows that teachers have taken up the forms of SCA but not the substance, that is, they have changed their behaviors in some ways without adopting the underlying principles (Brodie, Lelliott, & Davis, 2002).

Teachers did not view SCA and teacher-centered approach (TCA) as contrasting but as complimenting. Some said that they used SCA in Khmer language but TCA in mathematics. Others said they used SCA with difficult tasks and TCA with easy tasks. Yet some others said that they used SCA if the lesson was about a familiar topic and used TCA if the topic was new to the pupils. Teachers saw either SCA or TCA fits into different aspects of their teaching. This implies that, unlike reformers, teachers see SCA as an additional strategy rather than a change to their existing approach. In addition, most of teachers thought that the combination between the two approaches was necessary to deal with the real conditions of their classrooms, which are usually constrained by overcrowded classes, shortage of materials, and a pressure to cover overloaded contents. In short, it is fair to say that the 17-year-old SCA policy has only limited effects on instructional practices at classroom level.

Chapter 4: Instructional Organization

This chapter describes various aspects of instructional organization which includes arrangement of classroom space, pupils' grouping, and instructional materials and the organization of mathematics contents into classroom tasks.

A typical arrangement of space and seating in Cambodian classrooms looked very traditional: all pupils sitting in rows with their faces to the blackboard or the teacher on a raised floor in the front of the room. In a mathematics lesson, pupils spent 64%, 4%, and 30% of classroom time in whole-class, group, and individual activities respectively, indicating that classroom teaching was predominantly occupied by whole-class instruction which was observed to be composed mainly of teachers' presentation of new contents; teachers' comments on pupils' work (solution); and pupils copying text from the blackboard or textbooks. Teachers rarely used authentic materials in their classes, but mainly work with the blackboard and textbooks to pass

on the contents of the lesson to pupils. Only a minimal 1% of class time was spent with manipulative model (materials): real objects or pictures.

Using a coding scheme adapted from Hiebert and Wearne (1993) to investigate the representations of mathematical ideas as reflected in classroom tasks (*Table 2, attached*), the result shows that the majority of mathematical tasks (81%) were represented in the form of numerical symbol, 16% used stories, and only about 3% used physical materials. This suggests that in classroom activities pupils are still caught up in the abstract world of numbers and symbols. As far as the cognitive demand of instructional tasks is concerned, the study found that most of the tasks (80%) demanded skills in manipulating numbers (algorithm) without any connection to the underlying concepts or meaning. In addition, it was observed that even with originally high-level tasks (word problems), teachers, instead of asking pupils to think of and reason on how they should solve word problems, simply told the pupils what operation should be used and left only the computation for the pupils. This finding is in line with the accumulating literature (Doyle, 1983; Henningsen & Stein, 1997; Mergendoller et al., 1988; Stein et al., 1996) which consistently shows that pupils are very likely to be assigned with lower-level tasks intended to teach discrete skills.

Chapter 5: Teacher-Pupil Verbal Interaction

Employing Flanders' Interaction Analysis Categories (*Table 3, attached*), Chapter 5 describes the nature of classroom verbal communication. As expected, teacher talk made up a large portion of classroom verbal interaction at a rate of 83%, while pupil talk contributed only 17% to all verbal exchanges, indicating a clear imbalance of opportunity to talk between teachers and pupils. The most dominant forms of talk was lecturing, which constituted 40% of all classroom talk, followed by teachers' accepting and commenting on pupils' ideas at 17%. Also, only 2% of all classroom verbal exchanges were initiated by pupils, implying a scant opportunity for pupils to ask questions or discuss with the teacher and peers.

The analysis on the sequence of verbal exchanges by means of verbal codes pairing shows that pupils' responses were often preceded by teachers' questioning and followed by teachers' acceptance/comment (*Figure 2*). This pattern of exchanges is in line with the initiation-response-feedback (IRF) discourse pattern, which was found to be pervasive in primary classrooms (Edwards & Mercer, 1987; Mehan, 1979). Edwards and Mercers (1987) argue that as teachers respond to learner-centered policies, they find themselves in a dilemma where teachers have to "inculcate knowledge while apparently eliciting it" (p.126). Thus, they ask questions to which they know the answers in order to encourage pupils to participate and to monitor their understanding.
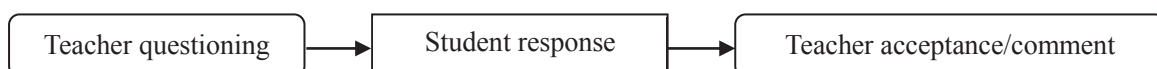
| Teacher questioning | → | Student response | → | Teacher acceptance/comment |

Figure 2 Sequence of classroom verbal interaction involving pupils' response

Chapter 6: Instructional Process and Pupils' Learning

Chapter 6 attempts to link features of instruction (instructional process) described in Chapter 4 and Chapter 5 with pupil's achievement in mathematics. The analysis was mainly conducted by matching the differences in test scores with the differences in instructional features between the four classrooms. The achievement test was jointly constructed by teachers, head teachers of mathematics in the target schools, and the researcher. The test was piloted and some items were modified before finally being administered to the pupils under the researcher's strict invigilation.

The evidence shows that the best-performing classroom was distinguished from the other classrooms in two main aspects with respect to instructional organization. The effective teacher was more efficient, thereby providing more opportunity to learn for pupils. The effective classroom completed more tasks per lesson despite the shorter duration of his lessons. This finding tends to corroborate the findings of expert teacher studies (Leinhardt, 1986) and research on active teaching (Brophy & Good, 1986; Rosenshine, 1983). Leinhardt (1986, p.30) found that expert teachers covered at least 40 problems a day orally in games, as jokes, or as written work, and assigned another 10 or 20 as homework. Another distinctive feature of the effective classroom is the use of multiple representations in mathematical tasks. Although there has no empirical evidence that one type of representation is better than the other, it has been shown that exposing pupils to multiple representations enhances their understanding of mathematical concepts (Hiebert & Carpenter, 1992; Mayer, Sims, & Tajika, 1995).

As far as classroom communication is concerned, the effective teacher was observed to provide more opportunity for pupils to talk or elaborate on their ideas. This finding has special implication for classroom teaching in Cambodia, where it is observed that pupils are rarely asked to talk about their opinions or explain their solution strategies to the classes. Moreover, although generally effective teachers asked fewer questions per lessons, they used more conceptual (higher-level) questions (*Table 4, attached*). This suggests that what matters in classroom communication is not how many (quantity) but what types (quality) of questions asked.

Conclusion

This study has examined the quality of education in Cambodian primary schools by attempting to link an array of factors to pupils' academic achievement. This section summarizes the findings and concludes the study with a brief policy implication.

Influences on learning

Through both quantitative and qualitative analyses, the study has identified several factors to have significant relationship with pupils' learning achievement. Concerning the effects of school resources (Research Question 1), it has been shown that schools with more experienced teachers, adequate guidebooks for teachers, and longer instructional time tended to produce higher level of pupils' achievement. As an out-of-school academic activity, private tutoring was found to exert a robust influence on academic achievement.

At the teaching and learning (process) level (Research Question 3), two key dimensions of instruction, i.e., classroom tasks (assignments or problems worked out by pupils during classes) and teacher-pupil verbal interaction have been investigated and linked to pupils' achievement. The results clarified that high-achieving pupils were more likely to study with a teacher who gave them more tasks to do per lesson and who presented the tasks in a variety of forms including numerical symbols, concrete objects, and stories. In addition, the effective teacher tended to get his or her pupils involved in elaborating their opinions or solutions of a problem. The effective teachers also asked more high-level questions than the less effective teachers.

Teaching and learning policy and classroom practice

With respect to the relationship between policy and its implementation (Research Question 2), it has become clear that although teachers exhibit a strong support for student-centered approach, such a high level of support was not followed by classroom practices associated with this reformed pedagogy. Instead, teachers only picked up some superficial aspects of student-centered approach and adopted them into their existing practices. While there was an emphasis on pupils' thinking skills in the policy, teachers' utilization of the new pedagogy was limited to the behavioral changes in their teaching practice. These changes included more pupils' activities and group work. However, these activities consisted mainly of computational problems or questions from textbooks and required little or no thinking. This clearly suggests that SCA innovation has only a limited effect on teachers' classroom practices.

Regional differences

With respect to regional disparity (Research Question 4), the study has detected some differences between the two districts in terms of educational resources, process, as well as pupils' learning outcome as measured by achievement test scores. Regarding resources, it was clear that there were a higher availability of guidebooks for teachers and extra instructional materials other than textbooks in the urban area (Angk Snuol district) than in the rural area (Preah Netr Preah district). The teachers in the urban area were also more experienced (as measured by years of teaching) than their counterparts in the rural area. However, it is interesting to find that teachers in the rural areas, on average, had significantly higher educational level and longer pre-service training than those in the urban area. Although this finding might defy general belief, it reflects the effects of Pol Pot regime on the Cambodian education system. Within the last decade, the government has strived to expand educational access to children in rural and remote areas. New schools have been built and new teachers have been recruited among lower secondary or higher secondary graduates and trained in a full two-year pre-service program. In contrast, even though new teachers have been employed in urban areas, the bulk of the urban teaching corps is still made up of those who started their teaching in the 1980s shortly after the civil war ended. These teachers were, in general, less educated and trained than those who started their services more recently.

Differences in instructional practices were also observed between the two districts. Classroom practices reported by rural teachers are more associated with student-centered

approach. For example, in mathematics lessons, rural teachers were more likely to engage pupils in solving word problems and making conjectures (i.e., reasonable estimates) while urban teachers tended to get their pupils to memorize formulas and rules. However, this should not be taken to mean that instruction in rural areas is student-centered because this study has proved that classroom instruction both in rural and urban areas were predominantly occupied by conventional practices. Nevertheless, the lean toward student-centered instruction of rural teachers must be acknowledged and this might be the result of longer exposure of rural teachers to training on student-centered approach. Generally, as shown above, most of rural teachers have had a full two-year pre-service training and they are often the targets of in-service trainings sponsored by development agencies such as UNICEF and other NGOs, which are more concerned with rural development.

The result of achievement test scores also exhibited a clear regional difference in academic achievement. Pupils in the urban area scored significantly higher than their rural peers. This superior performance of urban pupils can be attributed to the fact that school resources such as instructional time and materials as well as teachers' experience, which have been shown to be significantly associated with pupils' achievement, were more abundant in urban schools. Another explanation for this educational advantage of urban pupils is related to the fact that they had more opportunity to take private tutoring, also shown to be a significant determinant of achievement, as their families are generally more affluent than those living in rural areas.

Addressing the issue of what matters for educational quality as measured by achievement test scores, this study has identified resource factors to which policy makers should pay particular attention in order to improve pupils' achievement. The evidence found in this study suggested that interventions to boost pupil learning should target on a redeployment system which takes into account teaching experience, an improvement of teachers' resource bank (e.g., ensuring that every teacher has guidebooks), and a better management of instructional time. Not only will these resources improve educational quality, but also they are likely to reduce the regional achievement gap since rural areas are most in need of these resources. Quality of instruction at classroom level also plays a major role in enhancing pupils' learning. Teachers must learn how to get pupils actively involved in classroom tasks and how to effectively interact with them. It is indispensable that teachers learn how to smoothly and efficiently proceed from one instructional task to another and that the tasks pupils are assigned be presented not only in numerical symbols but also in other representations such as real life stories and physical materials. Equally important, it seems promising that teachers should strive to challenge pupils to think more by asking them a greater number of higher-level questions and allowing more opportunity for them to express their opinions in class.

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Map of Cambodia (attached)
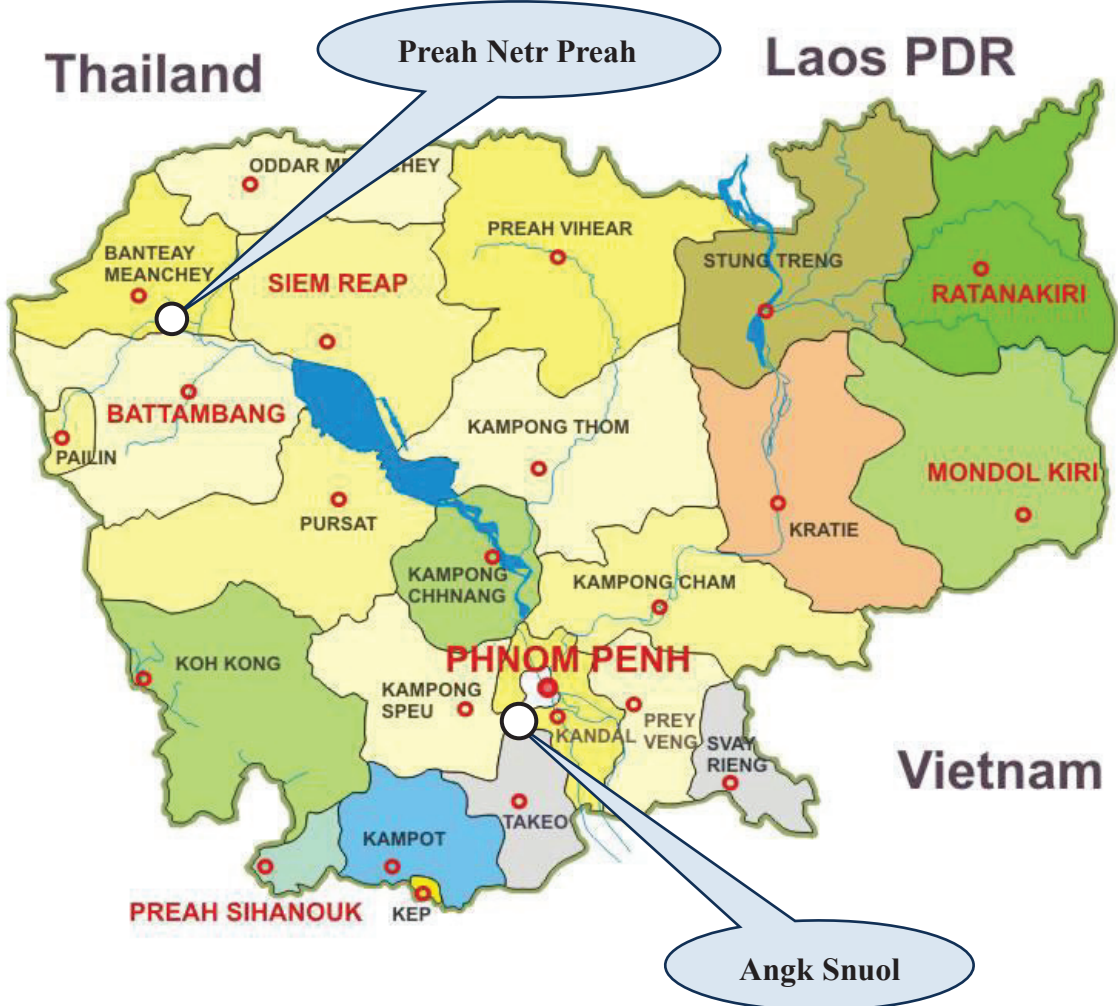
Tables (attached)

Table 1 Standardized regression coefficients (β) with academic achievement as outcome variable

	Model I	Model II	Model III
Individual characteristics			
Gender	.063 (.316, .156)[a]	.054 (.268, .162)	.049 (.241, .158)
Age	-.149** (-.322, .066)	-.132** (-.290, .074)	-.137** (-.301, .071)
Work	-.025 (-.064, .081)	-.053 (-.135, .084)	-.027 (-.067, .082)
Tutoring	.163** (.358, .067)	.136** (.293, .074)	.124** (.267, .073)
Homework	.021 (.088, .127)	.042 (.171, .130)	.016 (.063, .127)
Leisure	-.097* (-.425, .133)	-.078* (-.342, .140)	-.045 (-.196, .137)
Family characteristics			
Siblings		-.062 (-.086, .045)	-.061 (-.085, .044)
Parental education		.039 (.081, .074)	.001 (.001, .072)
Books at home		-.021 (-.031, .052)	-.054 (-.080, .052)
Home teaching		.066 (.117, .060)	.031 (.054, .060)
Pocket money		.144** (.384, .090)	.061 (.161, .093)
School inputs			
Textbooks			-.024 (-.104, .154)
Teacher guides			.124** (.250, .070)
Teacher education			.080 (.009, .004)
Teacher experience			.254** (.027, .004)
Class size			.002 (.001, .017)
Time loss			-.132** (-.378, .095)
Library books			.029 (.088, .106)
Multiple *R*	.278	.359	.445
R-Squared	.078	.129	.198

[a]Numbers in parentheses are unstandardized coefficients (*B*) and standard errors (*SE*)

*p<01, **p<001

Table 2 Coding scheme for representations of mathematical ideas (adapted from Hiebert & Wearne, 1993)

Codes	Example
Numerical symbol only	2$3/8$x4$1/4$=
Stories	A lady had 1$1/2$m of garment. From the garment, she made tablecloths, each of which consumed 3/4m of garment. How many tablecloths did she make?
Materials	The teacher got the students to use a scale to compare the weight of padlock and a book. The student noted their observation and wrote the answer on the board. (Classroom D, Lesson 2)

Table 3 Flanders' Interaction Analysis Categories (FIAC), (adopted from Flanders, 1970)

Teacher talk	Response	1. Accepts feeling
		2. Praises or encourages
		3. Accepts or uses ideas of pupil, *Commenting on students' work*
		4. Ask questions, *Dictating problems/exercises*
	Initiation	5. Lecturing
		6. Giving directions
		7. Criticizing or justifying authority
Pupil Talk	Response	8. Pupil-talk__response
	Initiation	9. Pupil talk__initiation
Silence		0. Silence or confusion

Table 4 Codes for cognitive demands of teachers' questions

Question type	Description	Example
Factual	Requesting a recall of factual information, rules, or definitions.	'What place is number 2?' 'How do we find the area of a rectangle?'
Computational	Requesting students to compute numbers.	'3 times 5?'
Procedural	Requesting students to describe a procedure or solution strategies.	'What should we do next?' 'Where is this number from?'
Evaluative	Requesting students to evaluate, compare, and reflect.	'Is her answer correct?' 'Where did you make mistake?'
Conceptual	Requesting students to think of the principles underlying the concepts.	'How do you justify your answer?' 'Which operation should we use?'